not reached even the perfection which systems of electrical lighting have attained.

JOHN TROWBRIDGE.

DR. GOULD'S WORK AT THE CORDOBA OBSERVATORY.

[THE Boston papers of last week Thursday gave a full account of the complimentary dinner given to Dr. Benjamin A. Gould on his return to this country, after the completion of his long series of observations in the Argentine Republic. We place before our readers that portion of the address made by Dr. Gould after the dinner, which narrates the history of his undertaking, on which he has expended nearly fifteen years. Want of space prevents our giving the introductory remarks in response to the warm welcome which he received from his hosts, or the many other excellent addresses upon the occasion.]

The undertaking began, as you know, with the project of a private astronomical expedition, for which my friends in Boston and vicinity had promised the pecuniary means. The selection of Cordoba as an especially desirable place was chiefly due to our lamented countryman, Gilliss, whose astronomical mission to Santiago de Chile had resulted in extensive and valuable observations of southern stars, and in the establishment of a national observatory, while it had enabled him to form a sound judgment as to the relative advantages of different points in South America for astronomical purposes, notwithstanding the total want of trustworthy meteorological data. This choice of place was confirmed by the counsel of the Argentine minister to this country. That minister was Sarmiento, a man who needs no encomium here; for during his brief residence in the United States he gained an exceptional number of friends and admirers. He transmitted to his government, then under the presidency of Gen. Mitre, my application for certain privileges and assurances, all of which were at once cordially conceded; but his interest in the plan became furthermore so great, that when, soon afterwards, he was himself elected president, he obtained the assent of the Argentine congress to the establishment of a national observatory, and wrote asking me to change my plans accordingly. The official invitation was sent in due time by the minister of public instruction, Dr. Avellaneda. The government assumed the expense of the instruments and equipments already bespoken, and authorized the engagement of the requisite assistants.

In 1874 Dr. Avellaneda succeeded Sarmiento in the presidency, and in 1880 he was himself succeeded by Gen. Roca. Thus four successive administrations have encouraged and sustained the undertaking; and notwithstanding the high political excitement which often prevails, and might easily have disinclined the members of any one party to give cordial aid to institutions established or fostered by their opponents, there has never been wanting a spirit of decided friendliness to the observatory, and to the scientific interests which have been developed under its auspices. No president of the nation, and no minister of the department under which the observatory is placed, has failed to give strong practical evidence of his good will. There has been none of them to whom I do not owe a debt of gratitude. I have never made an official request which has not been granted, and in such a way as to enhance the favor. And just as the official founders of the observatory met us with a cordial welcome on our arrival, so the government of to-day has overwhelmed me with kindness, and tokens of regard, on my departure. On the very last evening before embarking, when it was my privilege to receive the farewells of a crowded assemblage in the halls of the Argentine geographical institute, and to hear words of sympathy and commendation from the lips of Gen. Sarmiento, my earliest Argentine friend, speaking in behalf of that society, I replied in the few words which alone were possible at the time, but with all sincerity and truthfulness, as follows: —

"It was you, sir, who provided the opportunity for which I was yearning: it was the Argentine Republic which made it easy for me to avail myself of it. It has been the national government which, in its various phases, and under so many different administrations, always provided all needful means and resources: it is the Argentine people which has accompanied me in my tasks, giving support by their sympathy, and incentive by their kindness."

The original purpose of the expedition was to make a thorough survey of the southern heavens by observations made in zones between the parallel of 30° and the polar circle; but the plan grew, under the influence of circumstances, until the scrutiny comprised the whole region from the tropic to within ten degrees of the pole, — somewhat more than fifty-seven degrees in width, instead of thirty-seven degrees. And although it was no part of the original design to perform all the numerical computations, and still less to bring the results into the form of a finished catalogue, it has been my exceptional privilege, unique in astronomical history so far as I am aware, to enjoy the means and opportunity for personally supervising all that vast labor, and to see the results published in their definite, permanent form. Of course this has required time. The three years which I had purposed devoting to the less complete work have been drawn out to nearly fifteen; and you will comprehend what that implies for one who loves the friends of his youth, his kindred, and his country. Yet even here there has been consolation. For, while the work has demanded all that period, it did not absorb the whole time, and opportunity was left for other studies. Among the astronomical ones, it has been possible to examine all the stars as bright as the seventh magnitude, up to 10° of north declination, for careful estimates of their respective brilliancy, and to reform the arrangement and boundaries of the southern constellations; also to carry out the observations and computations for another stellar catalogue, more exact than that of the zones, and extending over the whole southern hemisphere. The

total number of different stars in this catalogue is less than in the other; but that of the observations is greater, since each star has been observed many times, as well as with greater precision. This catalogue, too, is at last finished, and in the hands of the printer; and thus it is that I am once more at home with you, my cherished friends.

I am hopeful that the data now collected may throw some additional light upon the great problem of the distribution of the stars in space. Yet, even should these prove insufficient, there is reason to believe that the new labors already begun by my successor, Dr. Thome, who has been connected with the observatory from the very first, will provide whatever additional information may be needful for the purpose. Among the other researches which have gone on while the preparation of the zone catalogue dragged its slow length along, has been a study of the meteorology of the country. The absolute lack of information on the subject had forced itself unpleasantly upon my notice when endeavoring to select the most suitable place for the observatory; and, as it would have been disgraceful for any scientific inquirer to reside in the country without trying to supply the want in some degree, I succeeded in enlisting the aid of various educated men and women in different parts of the country and adjacent ones. The government and congress acceded to my recommendation that a modest sum should be annually appropriated for the purchase of barometers, thermometers, rain-gauges, etc., to be lent to volunteer observers, and for arranging, computing, and publishing the results. In this way was organized, in 1872, the Argentine meteorological office, which has established no less than fifty-two stations, scattered from the Andes to the Atlantic, and from Bolivia to Terra del Fuego. At the end of the year 1884 there were already twenty-three points at which the observations had been continuously made, three times a day, for at least four years, and sixteen others at which they had already been continued for more than two years. These have provided the necessary data for constructing the isothermal lines with tolerable precision for all of South America, from the torrid zone to Cape Horn. Some little has also been accomplished in determining local constants of terrestrial magnetism; and our determinations of geographical position have nearly kept pace with the extension of the telegraph-wires. The beats of the Cordoba clock have been heard, and automatically recorded, amid the plash both of Atlantic and Pacific waves. And the series of longitude determinations made by the U. S. navy expeditions between Buenos Aires and Europe on the one side under Capt. Green, and between the United States and Valparaiso under Capt. Davis on the other, give, when combined with the two South-American measurements, values for the longitude of Cordoba which differ only by one-sixth of a second; this being the total amount of the aggregate errors of the several determinations in a series which, passing through Brazil, the Cape Verde Islands, Madeira, Portugal, England, Ireland, Newfoundland, the United States, Central America, and down the coasts of Ecuador, Peru, and Chile, completes the full circuit at Cordoba again.

But I will not descant upon collateral matters, nor convert this gathering of friends into an astronomical lecture-room. There are but two points more that I wish to mention. One is, that I cherish a hope that our sojourn at Cordoba may hereafter be considered as marking an epoch in a new method of astronomical observation, namely, the photographic. The inception and introduction of this method belongs to our countryman, Mr. Rutherfurd; and it was only through his friendly aid in several ways that I was enabled to give it a larger scope, in spite of many obstacles. Now, I can report that every important cluster of stars in the southern hemisphere has been repeatedly photographed at Cordoba, with a precision of definition in the stellar images which permits accurate microscopic measurement; that these measurements are now actively going on; and that the Argentine government has undertaken to provide the means for their continuance under my supervision. It may be that I over-estimate the importance of this new method; but I confess that my expectations are very high. Another year ought to show us whether they are exaggerated or not.

The other point is, that a very large share of the merit which you so liberally attribute to me belongs to the faithful staff of fellow-workers with whose assistance I have been singularly favored. This unselfish devotion to the great undertakings in which they took part, their loyalty, trustworthiness, and ability, have, in the great majority of cases, been beyond all praise. Happily, their faithful and inestimable services to science are placed on durable record; and yet unborn astronomers will know, at least in part, how great have been their deserts. The senior of them, Dr. John M. Thome, whose services began in 1870, before we started southward, is now director of the observatory, where he has begun a new and important work, which will do honor to him and to the institution. Another, Mr. Walter G. Davis, who has labored most earnestly and efficiently for eight years and a half, is now director of the meteorological office, which is assuming large proportions, and under which he is now organizing a meteorological station of the highest class. One noble young man, Mr. Stevens, was summoned, without an instant's warning, to a higher reward than earth could give, leaving no memories behind him other than of affection, admiration, and respect. It was a sore loss for us, and for the bereaved parents in New Hampshire, to whom he was their only earthly stay and staff. Had he lived, his friends and country would have had abundant cause for pride in him. As it is, the number of those who love and honor his memory may perhaps be smaller, but their pride and admiration are no less than had they seen the full harvest instead of the rich promise only. Mr. Bachmann, a native of Austria, who labored with us for more than ten years, is now at the head of the Argentine naval academy in Buenos Aires, with more than three hundred pupils, and an elegant little observatory, where he finds repose from administrative cares in

astronomical work analogous to that to which he gave his energies at Cordoba. He has already undertaken some longitude determinations, and arranged a time-ball, which is probably already giving daily signals, by which the shipping in the outer roads, twelve miles away, may correct and rate their chronometers.

I have spoken longer than I intended, but will make no apologies, for I know your friendly indulgence. It only remains to say for these Argentine scientific institutions, that I believe their success to be now assured; they will enter upon new and enlarged fields of usefulness, as indeed they ought, for the world moves; and, for myself, that the remembrance of this occasion and of your overwhelming kindness will be a source of pride to me through life, and to my children afterwards.

SEMITIC LANGUAGES AT HARVARD.

IN a programme of the Semitic courses given by Professors Toy and Lyon in Harvard university, we find the following statements interesting to the young student. The Semitic family (one of the two inflecting families of the world, the other being the Indo-European) is divided into two groups, in which the several languages are distributed as follows: —

- North-Semitic.
  - 1. Babylonian-Assyrian.
  - 2. Aramaic.
    - Classical Aramaic (Syriac).
    - Palmyrene.
    - Jewish Aramaic.
    - Samaritan.
    - Various modern dialects.
  - 3. Canaanitic.
    - Phoenician, older and later (Punic).
    - Hebrew, biblical and post-biblical.
    - Moabite, etc.
- South-Semitic.
  - 4. Arabic, classical, and modern dialects of the Bedawin, and of Egypt, Algeria, and Syria.
  - 5. Sabean, embracing several dialects.
  - 6. Ethiopic, and the modern related dialects, Amharic, Tigre, Tigriña.

The two groups differ from each other considerably in grammar and lexicon. A member of either is much nearer to its fellow-members than to any member of the other; thus, Assyrian is more important than Arabic for Hebrew lexicography, and Ethiopic and Arabic are of more value than Hebrew or Aramaic for Sabean. Still, all these languages have much in common with one another, and each throws light on the others.

The choice of a student will depend on his special aim. Aramaic is the simplest Semitic language in forms, is necessary for the study of the Talmud (Gemara), and contains material for biblical textual criticism, and for the ecclesiastical and secular history of the first sixteen or seventeen centuries of our era. Hebrew is indispensable for the critical study of the Old Testament and Talmud (Mishna). Assyrian is grammatically interesting, and valuable for the early history of western Asia, and for North-Semitic civilization in general. Phoenician exists almost wholly in inscriptions, — a few of which are of historical importance (B.C. 500–A.D. 150), — and in Latin transcription in the Poenulus of Plautus. Arabic has most fully preserved the old inflectional forms, is indispensable in the study of general Semitic grammar, and has a large and varied literature, of which the historical part is of great value, and the poetry interesting. Sabean, or Himyaritic, is found only in inscriptions, which have recently revealed the existence of an ancient and remarkable civilization in southern Arabia, and a language presenting noteworthy peculiarities. Ethiopic, nearly related to Sabean, is the language of the Christian period of the Semitic colony in eastern Africa. Its literature consists of a Bible translation, monkish chronicles, and versions of several important apocalyptic books. The grammar is remarkable for the symmetry of the verb. At present it has been replaced by various related dialects, one of which was the language of the late King Theodore of Abessinia.

No genetic relation between the Semitic and Indo-European families has yet been discovered. The lexicon of the one does not help that of the other, and only the most general connection exists between their grammars. It is only a seeming exception to this statement, where one language has borrowed from another, as is the case with the modern Persian and the Hindustani, a large part of whose vocabularies is taken from the Arabic, and the Eranian Huzvaresh, which has taken much from Aramaic. Turkish, a member of still another family, is similarly indebted to Arabic.

THE STONE AGE IN AFRICA.

AT the meeting of the Royal society of northern antiquaries, held April 14, 1885, L. Zinck gave an account of the discoveries hitherto made regarding the stone age of Africa. There was now no doubt that Africa had its stone age, as well as Europe. Both in the old cultivated land of Egypt and the well-known desert of Sahara, the inhabitants in their time had only instruments of stone; but he would speak only about the stone age of South Africa. About twenty years since, was made the first find of stone objects in the region of the Cape of Good Hope. We know now that the natives on the south-west coast of Cape-land, even at the end of the sixteenth century, paid extravagant prices for iron, and Magaelhens had before found the natives of Madagascar using weapons of iron. Relics of the stone age are also found among the Bushmen, who were driven back to the Kalabari desert, and whose arrow-heads were of stone. There are found in South Africa, from an ethnological point of view, three peoples, — the Kaffirs, Hottentots, and Bushmen, — who represent three waves of migration. The last are the oldest people of the land, and have in their time extended themselves far to the south, where, in the rocky hollows, they have left monuments of various kinds, executed with much ability. They were acquainted with perspective, and had an appreciation of caricature. The Hottentots later drove them back, but were themselves driven back by the Europeans and the Kaffirs. The last, who came from the north, began to encroach on the Cape territory